

PATENT SPECIFICATION

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(19)



(54) PHOTOGRAPHIC CAMERA

(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, United States of America do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to the control of exposure duration in photography and, more particularly, to an improved camera having means for minimizing the errors in exposure times determined by photosensitive exposure control apparatus when illuminated by flash light as compared to substantially constant light e.g. daylight. Many camera shutters vary the time interval of exposure automatically in response to substantially constant light and in response to transient (flash) light. The flash light output and mechanical movement of the shutter to initiate the exposure are synchronized. Operation of timing apparatus that establishes a time interval of exposure for the shutter is also synchronized with the mechanical movement of the shutter. Generally, the timing apparatus is coupled to the shutter in such a manner that the time interval of exposure determined thereby begins before the shutter actually opens and ends before the shutter actually closes. That is, when the timing apparatus is actuated to begin the time interval there is a delay before the shutter actually opens. Also, at the end of the time interval as determined by the timing apparatus, there is a delay before the shutter actually closes to terminate exposure. If, however, these delays are equal in duration and scene illumination remains fairly constant, correct exposure results. When photographing a scene illuminated by flash light, the latest

the time interval can effectively be initiated is when light from the flash light output is reflected onto a photosensor forming part of the timing apparatus. The light output of a flash light varies with time and considerably more output occurs after the peak output than before. To obtain maximum photographic use of flash light output, the shutter opens before peak light output occurs. Thus, the time interval cannot in any way be initiated before the shutter opens in a manner such as to offset equally the delay in closing the shutter after the time interval ends. An additional unwanted exposure is created. Although the additional exposure time is small, the resultant over-exposure of the sensitive material is great in view of the relatively high intensity and short duration of the flash light.

It is an object of the present invention to provide an improved camera wherein the aforesaid exposure errors are minimized.

According to the present invention, there is provided a camera, adapted to make exposures in a daylight mode and in a flash light mode, including a distance setting means, a photosensor responsive to scene light for determining the exposure time, first means operable in the daylight mode for reducing the response of the photosensor to the light by a predetermined amount and second means operable in the flash light mode for varying the response of the photosensor to the light, in dependence upon the setting of the distance setting means.

The present invention will be described further, by way of example, with reference to the accompanying drawings in which:-

Fig. 1 is a diagrammatic view showing a typical camera exposure control mechanism to which the present invention is applicable;

Fig. 2 is a fragmentary view of a camera according to the present invention as it would appear when no flash unit is coupled to the camera;

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Fig. 3 shows the camera of Fig. 2 as it would appear with a flash unit coupled to the camera and with the camera focus adjusted for a medium-range flash exposure;

Fig. 4 is a view, similar to Fig. 3, but with the camera set for extreme close-up flash exposure; and

Fig. 5 is a view similar to Fig. 3, of a second embodiment according to the present invention.

As photographic cameras are well known, the present description will be directed in particular to those camera elements concerned with the present invention, camera elements not specifically shown or described herein being understood to be selectable from those known in the art.

Referring first to Fig. 1, there is shown a schematic representation of an exposure control mechanism usable in a camera incorporating the present invention. The apparatus includes a shutter comprising blades 10, 12 respectively biased by springs 14, 16 to open and to close an exposure aperture 18. The blade 10 is latched in its cocked position shown in Fig. 1 by a latch 20 operatively connected with a release mechanism 22 of the camera. A spring 23 biases the latch 20 into its latching position. When the release member 22 is operated, the latch 20 releases the blade 10, and the blade 10 pivots counterclockwise, as viewed in Fig. 1, to uncover the exposure aperture 18, (this position is not shown). After the blade 10 moves to uncover the aperture, the blade 12 is held in a position to the left of the aperture 18, in which position the aperture 18 is exposed to light. An armature 24, coupled with an electromagnet 26, holds the blade 12 in such position. An electronic circuit 28, including a photosensor 30 exposed to scene brightness, regulates the state of energisation of the electromagnet 26 in relation to scene brightness. The electromagnet 26 is energised at the start of an exposure to hold the armature 24 and thus hold the blade 12 in the position shown in Fig. 1. A timing capacitor 34, part of the circuit 28, is charged at a rate depending upon the current in the photosensor 30, the charge rate thus being related to the level of scene brightness. In the event of exposure at high scene brightness, the capacitor 34 charges at a rapid rate; during exposure at a lower scene brightness, the capacitor 34 charges at a correspondingly lower rate. When the capacitor 34 reaches a predetermined charge level, the circuit 28 de-energises the electromagnet 26; and the armature 24 releases the blade 12 to cover the aperture 18. The exposure time (opening and closing of the shutter) is thus related to the level of light striking the photosensor 30. A switch S_1 shunts the capacitor 34 to ground prior to

the time that the shutter is open. The switch S_1 is opened when the blade 10 is released so that the timing of the shutter is synchronized with the opening of the shutter. Such operation is well known in the art.

A preferred embodiment of the relevant part of a camera incorporating the present invention, positioned in its normal operating condition for ambient (substantially constant light above a predetermined level) exposure, is shown in Fig. 2. The positions of the elements there shown, when an exposure is made by flash light, are dependent upon subject distance and are illustrated in Figs. 3 and 4. The camera of the present invention can use an automatic exposure control apparatus as shown in Fig. 1 and minimizes the difference in film exposure between an exposure made with ambient and an exposure made with flash light. The minimization is accomplished in a camera according to the present invention by selectively positioning first and second light attenuating elements, such as, for example, filters 40, 42 into and out of the optical path of the photosensor 30 depending upon whether exposure is being made in ambient or flash light, and in the latter instance upon the distance to the photographic subject.

The filter 40, which may comprise a combination spectral and neutral density filter of substantially constant density, is mounted on a T-mount 44, which operates in the manner of a bellcrank and comprises an arm 46 upon which the filter 40 is mounted, an arm 48 generally perpendicular to the arm 46, which extends into a flash unit receiving socket 50, and a third arm 52 which engages and interlocks with a mount 54 for the filter 42. A spring 56 urges the T-mount 44 counterclockwise, as viewed in Fig. 2, into the position in which the arm 48 engages a wall of the socket 50; the filter 40 is thus held within the optical path of the photosensor 30. The mount 54 is pivotally mounted to structure, partially shown, and positions the filter 42 to one side e.g. the left side in Fig. 2, of the optical path of the photosensor 30. The arm 52 holds the mount 54 in the position shown in Fig. 1 against the force of a spring 58 which urges the mount 54 counterclockwise, toward a position in which the filter 42 is within the optical path of the photosensor 30. The filter 42 is of variable density such as, for example, a wedge having tapered thickness and is carried by the mount 54 so that the effective density in the optical path will increase as the filter moves to the right from its Fig. 2 position. Well known formulas relate the optical density of the filter 42 to change in f /stops of exposure. As seen by the photosensor 30, the change in thickness may, for example, range from approximately zero (0) density when the

thinnest or no portion of the filter 42 is within the optical path (corresponding to zero f/stop exposure correction), to 1.0 density when the filter 42 is fully to the right 5 and has its thickest portion within the optical path (corresponding to approximately a three f/stop change in exposure). Thus when the thickest portion of the filter is within the optical path, the capacitor charges at a rate 10 which increases the length of exposure by three f/stops over the exposure obtained when no portion of the filter 42 is within the optical path.

The filter 42 may be selectively 15 positioned along its locus of travel to place a particular thickness in the optical path of the photosensor 30 in relation to focus of the camera. This is accomplished by means of an L-shaped lever 60 that controls the position 20 of the filter 42 within the optical path relative to the setting of a camera focus control 62. The lever 60 is coupled to the focus control 62 by a cam runner 64 on the lever 60 that moves along cam surface 66 on the focus control 62. A spring 69 biases the lever 60 to a position in which the cam runner 64 engages the cam surface 66, and a head 70 of the lever 60 is moved to various positions relative to the position of the mount 54, each position being related to a subject distance as established by the focus control 62. The further the subject distance, the thicker the wedge portion of the filter 42 placed within the optical path. The focus control 62 is slidably mounted on the structure by means including a post 72 received in a slot 74 of the focus control 62. The post 72 also mounts a sector gear 76 for pivotal motion thereabout. The focus control 62 is also coupled to the sector gear 76 through a pin 80 on the sector gear 76 that is recessed in a slot 82 of the focus control 62. The sector gear 76 engages a toothed section 86 of a lens ring 88, aligned with the aperture 45 18; through the pin-slot arrangement and gear relationship, the lens ring 88 follows movement of the focus control 62.

During operation of the exposure control apparatus when exposure is illuminated by ambient light, the apparatus of the invention 50 is in the position shown in Fig. 2, the filter 40 being within the optical path of the photosensor 30. When the switch S_1 is opened, capacitor 34 charges at a rate that 55 takes into account inertial lags in the shutter and a properly timed exposure results. When ambient light decreases to a level requiring flash illumination, a flash unit 90 is inserted into the socket 50 and contacts 60 the arm 48. The T-bar mount 44 is pivoted clockwise, swinging the filter 40 out of the optical path of the photosensor 30. When the T-bar mount 44 is swung clockwise, the arm 52 disengages from the mount 54 and 65 the spring 58 moves the mount 54 in a coun-

terclockwise direction. The filter 42 is moved into the optical path of the photosensor 30, along a locus of travel to increase the density over the photosensor 30. Referring to Figs. 3 and 4, there are shown two different settings of the focus control 62 for which the filter 42 occupies different positions within the optical path of the photosensor 30. In Fig. 3, the setting corresponds to, for example, five feet on the focus control 62, 75 resulting in the mount 54 moving the filter 42 a predetermined distance into the optical axis, in which a density, for example, equal to .15 is placed into the optical path. Fig. 4 shows the focus control 62 at a close-up setting of, for example, three or four feet in which both filters 40 and 42 are completely outside of the optical path. When the switch S_1 is opened, in the case when the focus control 62 is set at five feet, the filter 42 passes 85 light to the photosensor 30 to cause the capacitor 34 to charge at an intermediate rate that considers the amount of reflected light. The rate of charge is somewhat slower than the extreme close-up condition shown 90 in Fig. 4 (with both filters removed), but faster than the rate of charge when focus control 62 is set at nine feet or beyond, when filter 42 will have interposed a density of 1.0 in the optical path. Thus the charging 95 rate of the capacitor 34 has been altered during exposure illuminated by flash light. The charge rate is now related to reflected light, influenced by subject distance. The unintended exposure is eliminated. 100

In a second embodiment illustrated in Fig. 5, a single filter 42 is employed. The filter 42 has a section 40, a zero density section 42a and an increasingly dense section 42b. The flash unit sensing arm 48 is pivotally 105 connected at 48a to a tie rod 40b at the lower end of which a pin locates in a slot 60a of the lever 60. When no flash unit is attached to the camera, the spring 56 pivots the arm 48 in a counter clockwise direction 110 and the tie rod 48b, via the pin and slot connection 60a, lifts the lever 60 so that the cam runner 64 is clear of the cam surface 66. In so doing, the lever 60 positions the daylight section 40 of the filter 42 in front of the 115 photosensor 30. When a flash unit 90 is inserted in the socket 50, the arm 48 is pivoted in a clockwise direction against the action of the spring 56 to lower the cam runner 64 onto the cam surface 66. The 120 spring 69, which is weaker than the spring 56, biases the lever 60 to ensure engagement between the runner 64 and the surface 66 and the pin and slot connection 60a permits the lever 60 to be pivoted by the runner 125 64 to position, in dependence upon the setting of the distance setting member 62, the appropriate section 42a to 42b of the filter 42 in front of the photosensor 30.

A further embodiment is envisaged in 130

which a vertically reciprocable sensing member is provided. The sensing member is spring loaded to its sensing position in which a sensing finger projects into the flash unit holder 50 and insertion of a unit 90 serves to depress the sensing member against its spring loading. At its lower end, the sensing member has a lost motion pin and slot connection with the lever 60 which operates identically to the operation of the tie rod connection in the second embodiment. When the flash unit is removed from the holder 50, the sensing member moves vertically under its spring loading and lifts the lever 60, against the bias of the spring 69, so that the cam runner 64 is lifted clear of the cam surface 66.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the scope of the invention as defined in the appended claims.

WHAT WE CLAIM IS:-

1. A camera, adapted to make exposures in a daylight mode and in a flash light mode, including a distance setting means, a photosensor responsive to scene light for determining the exposure time, first means operable in the daylight mode for reducing the response of the photosensor to the light by a predetermined amount and second means operable in the flash light mode for varying the response of the photosensor to the light, in dependence upon the setting of the distance setting means.

2. A camera as claimed in Claim 1 wherein the first and second means respectively serve to attenuate and to vary the light impinging on the photosensor.

3. A camera as claimed in Claim 1 or 2 wherein the first means comprises a daylight filter having a predetermined density positionable in front of the photosensor.

4. A camera as claimed in Claim 1, 2 or 3, wherein the second means comprises a neutral density filter, the density of which varies between zero and a predetermined maximum value, the neutral density filter

being positionable, in the flash light mode, in front of the photosensor with the zero density portion being so located when the distance setting means is at its nearest distance setting.

5. A camera as claimed in Claim 1, 2, 3 or 4 wherein the distance setting means comprises a cam surface and the second means is operatively positioned, in the flash light mode, by a cam runner engaging said surface.

6. A camera as claimed in any preceding claim wherein the first and second means comprise sections of a continuous filter of varying density.

7. A camera as claimed in Claims 5 and 6 wherein the first and second means are mounted on a lever having the cam runner and arranged to be disengaged from the cam surface, in the daylight mode to position the filter section appropriate to the reduction in response of the photosensor for daylight, in front of the photosensor.

8. A camera as claimed in any of Claims 1 to 5 wherein the first means is mounted on a first member biased towards its operative position and the second means is mounted on a second member biased towards its operative position the first member, in the operative position, serving to hold the second member in the inoperative position.

9. A camera as claimed in any preceding Claim including a flash light unit holder and means responsive to the insertion of a flash light unit thereinto, to render operative the second means for varying the response of the photosensor and to render inoperative the first means.

10. A camera as claimed in Claims 8 and 9 wherein the means responsive to the insertion of a flash light unit constitutes an arm of the first member.

11. A camera substantially as herein before described with reference to and as illustrated in Figs. 1 to 4 or Figs. 1 to 4 as modified by Fig. 5 of the accompanying 95 drawings.

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which a vertically reciprocable sensing member is provided. The sensing member is spring loaded to its sensing position in which a sensing finger projects into the flash unit holder 50 and insertion of a unit 90 serves to depress the sensing member against its spring loading. At its lower end, the sensing member has a lost motion pin and slot connection with the lever 60 which operates identically to the operation of the tie rod connection in the second embodiment. When the flash unit is removed from the holder 50, the sensing member moves vertically under its spring loading and lifts the lever 60, against the bias of the spring 69, so that the cam runner 64 is lifted clear of the cam surface 66.

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3. A camera as claimed in Claim 1 or 2 wherein the first means comprises a daylight filter having a predetermined density positionable in front of the photosensor.
4. A camera as claimed in Claim 1, 2 or 3, wherein the second means comprises a neutral density filter, the density of which varies between zero and a predetermined maximum value, the neutral density filter

being positionable, in the flash light mode, in front of the photosensor with the zero density portion being so located when the distance setting means is at its nearest distance setting.

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